

# **Telem SCADA System**

## **Telem Data Concentrator Software manual**



## Contents

<b>1. COMMON DESCRIPTION.....</b>	<b>4</b>
<b>2. FILES AND FOLDERS.....</b>	<b>5</b>
<b>2.1. PROGRAM WORKING FOLDER.....</b>	<b>5</b>
<b>2.2. PROGRAM CONFIGURATION FILE.....</b>	<b>5</b>
<b>2.3. DATABASE AND RUNTIME INFORMATION.....</b>	<b>8</b>
<b>3. CONCENTRATOR CONFIGURATION TABLES.....</b>	<b>9</b>
<b>3.1. CONFIGURATION OF COMMUNICATION CHANNELS AND CONTROLLERS.....</b>	<b>9</b>
<b>3.2. CONFIGURATION OF MEASUREMENT AND CONTROL OBJECTS .</b>	<b>16</b>
<b>3.3. TRANSFER OF CONCENTRATOR'S STATUS INFORMATION TO UPPER LEVEL.....</b>	<b>18</b>
<b>3.3.1. CONCENTRATOR'S STATUS INFORMATION WITH TELEM PROTOCOL.....</b>	<b>18</b>
<b>3.3.2. CONCENTRATOR'S STATUS INFORMATION WITH IEC 60870-5-101 PROTOCOL.....</b>	<b>20</b>
<b>3.4. SWITCHING PERMISSIONS OF DISPATCH CENTERS.....</b>	<b>20</b>
<b>3.4.1. CHANGE OF SWITCHING PERMISSIONS IN CASE OF TELEM - TELEM CONVERSION.....</b>	<b>20</b>
<b>3.4.2. CHANGE OF SWITCHING PERMISSIONS IN CASE OF IEC PROTOCOL USE.....</b>	<b>21</b>
<b>3.5. TIME SYNCHRONIZATION CONFIGURATION.....</b>	<b>21</b>
<b>3.5.1. TIME SYNCHRONIZATION OF LOWER LEVEL DEVICES.....</b>	<b>21</b>
<b>3.5.2. RECEPTION OF TIME SYNCHRONIZATION.....</b>	<b>22</b>
<b>4. DISPLAYING THE STATUS INFORMATION.....</b>	<b>23</b>
<b>4.1. DISPLAYING THE STATUS INFORMATION OF COMMUNICATION WITH LOWER LEVEL EQUIPMENT.....</b>	<b>23</b>

<b>4.2. DISPLAYING STATUS INFORMATION OF UPPER LEVEL COMMUNICATION CHANNELS.....</b>	<b>24</b>
<b>5. DISPLAYING THE MEASUREMENT INFORMATION.....</b>	<b>25</b>
<b>5.1. DISPLAYING THE MEASUREMENT INFORMATION ON TELEM - TELEM CONVERSION.....</b>	<b>25</b>
<b>5.2. DISPLAYING THE MEASUREMENT INFORMATION OF CONFIGURED OBJECTS.....</b>	<b>26</b>
<b>5.3. DISPLAYING BUFFERED TELEM PROTOCOL EVENTS.....</b>	<b>28</b>
<b>6. CONFIGURING THE TELEM RTU-S.....</b>	<b>29</b>
<b>6.1. CONFIGURING THE RTU MODULES.....</b>	<b>29</b>
<b>6.2. SENDING RESET COMMAND TO TELEM RTU MODULES.....</b>	<b>30</b>
<b>7. UPDATING CONCENTRATOR'S PROGRAM AND CONFIGURATION INFORMATION.....</b>	<b>31</b>

## 1. Common description

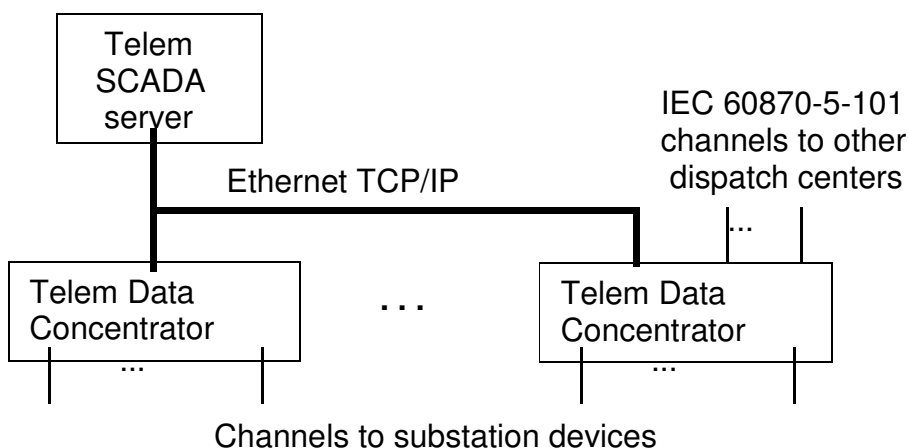
The purpose of Data Concentrator can be:

- To concentrate the data from serial communication channels and transfer it over Ethernet LAN to SCADA server.
- Retransfer the information over serial channels to other SCADA systems
- Convert the IEC 60870-5-103, IEC 60870-5-104, COURIER, DNP 3.0, Modbus and TELEM protocols to IEC 60870-5-101 and IEC 60870-5-104 communication protocols
- To split the communication channels (one input channel can be split to two or more output channels)

One concentrator can be connected to up to 32 communication channels (with four 8 port serial communication cards).

Every communication port can be used for:

- Connection to lower level channel with up to 16 devices
- Connection to upper level computer



IEC 60870-5-101, IEC 60870-5-104, IEC 60870-5-103, COURIER, DNP 3.0, Modbus, TELEM communication protocols.

The Concentrator enables:

- Transfer the information from one lower level communication channel to several upper level communication channels
- Conversion of communication protocols
- Event buffering and transfer to dispatch centers
- Transfer the switching commands from DP centers to substation devices
- Change the rights of control operations from DP centers
- Transfer the information about failures of communication channels to dispatch centers

## 2. Files and folders

### 2.1. Program working folder

Working folder is usually named: C:\Telem\

It consists the following files:

- TDC.EXE – Program
- DNPX\_DLL.DLL – DNP 3.0 protocol module
- QTINTF70.DLL, QTINTF.DLL – Specific libraries
- TIMEOUTS.TXT – Timeout parameters for serial communication channels
- TERMS.TXT – Translation file
- TDC.CONF – Configuration parameters of program

### 2.2. Program configuration file

Program setup data is held in file TDC.CONF which has to be in same folder with working program.

Parameters are identified by parameter names followed by = sign and parameter value.

Comment lines are started with # sign.

File **TDC.CONF** consists the following parameters:

- **DB\_name**=Tlm\_Gate  
Database name name in Borland Database Engine (BDE) configuration
- **Data\_path**=C:\G\_Data  
Folder name where the runtime data files are held
- **TLM\_RTU\_DB\_Path**=C:\Tlm\_Contr\_Config  
Folder for configuration files of Telem RTU modules. This parameter influences only the remote configuration of devices.
- **Watchdog**=FALSE  
Use of the computer watchdog (on industrial PC). Since the sudden restart is not healthy for Windows operating system, this parameter is usually set to False.
- **Failure\_command**=RESET  
If allied then causes the Reset (instead of Shutdown) of computer when the program detect a severe error in computer behaviour. This parameter is used when the computer watchdog is turned off.
- **Allowed\_comm\_err**=3  
No. of allowed sequential communication errors, which does not cause an indication of communication error yet.
- **Server\_ip**=10.0.0.181  
IP address of Server
- **Server\_port**=2402  
IP Port no.

- **Reserv\_Server\_ip=10.0.0.182**  
IP address of reserved Server
- **Reserv\_Server\_port=2402**  
IP Port no. of reserved Server
  
- **Parallel\_server\_ip=10.0.0.66**  
IP address of parallel Server. All the messages, which are sent to the first server are also sent in parallel to the second server.  
**Parallel\_server\_port=2402**  
IP Port no. of second Server
  
- **Mirror\_IP=10.0.0.71**  
IP address of reserved concentrator
- **Mirror\_Data\_path=\\10.0.0.71\C\G\_Data**  
Data path for runtime data in reserved concentrator
  
- **Shutdown\_port=0**  
Port no. for connecting the computer shutdown signal. The front of CTS signal of this port causes the computer shutdown. If it's 0 or commented out then it's not used. On a positive value the positive front and on a negative value the negative front causes the shutdown. The shutdown port is used together with UPS device
  
- **MAX\_GW3\_DEVICES=20**  
Telem GW3 concentrator specific parameter which has to match to GW3 firmware, which is configured via this software. This parameter influences only the remote configuration of devices.
- **GlobalID=2**  
The version number of data object's global ID format: 1 - old format, 2 - new format
  
- **Offline\_control=BOCA\_DTR\_DCD**  
If used then on offline channels the RTS output emulates the DTR and CTS input is used for DCD signal. This is used on multiport cards, which does not have the DTR and DCD signals. This case needs also the special wiring.
- **Offline\_dial\_out=SEPARATE\_DIAL\_OUT**  
If used then separate telephone modem is used for dialing out.
  
- **without\_not\_topicals=No**  
On "Yes" the "Not Topical" attributes are not set on communication errors.
  
- **Courier\_Events=False**  
Disables the reception of BI events on Courier protocol

- **Without\_error\_beep=No**  
Disables the sound on communication errors.
- **OnStartup\_Minimized=No**  
On startup minimizes the main window.
- **OnStartup\_hide\_LL\_ch=No**  
On startup hides the window of lower level channels
- **OnStartup\_hide\_HL\_ch=Yes**  
On startup hides the window of upper level channels
- **GlobalID=2**  
The version number of global ID format: 1 - old format, 2 - new format. Do not change this value unless you know what you are doing!
- **104\_server\_port=2404**  
TCP/IP port number of IEC 60870-5-104 protocol server socket
- **104\_server\_debug\_window=False**  
Disables/enables the debugging window of 60870-5-104 protocol server connection.
- **104\_server\_timeout=50**  
Time of waiting the end of already partly received message [ms]

## 2.3. Database and runtime information

The configuration information of communication channels and objects is held in Paradox format database files in folder C:\Tlm\_Gateway\_Config.

For saving Concentrator's configuration in security reasons it's recommended to make a copy of this database file and keep it separately from Concentrator computer.

The configuration information of Telem RTU configuration is buffered in Paradox format database files are usually held in folder C:\Tlm\_Contr\_Config if not configured otherwise.

The runtime information data is usually held in folder C:\G\_Data if not configured otherwise.

The following files are in use for runtime data:

- CNT\_ERRS.PFL – The numbers of communication errors on lower level channels
- yyyyymmdd.EVN – TELEM protocol event files, where yyyy represents a year, mm represents a month and dd represents a day. On change of a day the file is renamed or the new file is created. It depends on number of events saved to file. So there is no separate file for every day.
- REST\_CNT.TXT – The number of Concentrator program's starts
- CS\_LOG.TXT – Program log



### 3. Concentrator configuration tables

#### NB!

All the following configuration tables have to be filled up on Telem SCADA server side to maintain the data integrity. On concentrator side these tables should be used only for checking purposes on the time of testing.

### 3.1. Configuration of communication channels and controllers

The corresponding tables are displayed and edited under the main menu item *Settings / Channels and controllers*.

**Settings of channels and controllers**

**Lower level channels**

Chan.	Protocol	Port	Speed	Parity	Duplex (D/H)	Controllers	Delay	In use(Y/N)	Status BI	Telem addr.	Status TS	Comment
1	IEC	7	38400	N	D	4		Y				Telem DSP
2	Telem	5	1200	D	D	4		Y				Telem
3	IEC	6	19200	E	D	6		Y				Alstom
4	IEC	10	19200	E	D	2	20	Y				Alstom 485

**Controllers**

Contr.	Chan.	Prot. ver.	Retr. addr.	Link addr.	ASDU addr.	Link addr.	ASDU addr.	Inf. obj. addr.	Adjust (Y/N)	Addr.	In use(Y/N)	chan.	St. BI	Addr.	St. TS
1	1			2	2	1	2	2	Y	64511	Y	1	2901		
2	1			3	3	1	2	2	Y	64511	Y		2902		
3	1			4	4	1	2	2	Y	64511	Y		2903		
4	1			5	5	1	2	2	Y	64511	Y		2904		
5	2	5	16	16							Y	255	2905		
6	2	5	17	17							Y	255	2906		
7	2	6	28	28							Y	255	2907		
8	2	6	29	29							Y	255	2908		

**Upper level channels**

Chan.	Protocol	Prot. ver.	Port	Speed	Parity	Duplex (D/H)	In use(Y/N)	IEC	IEC addr. lengths	St. and contr. perm. with IEC					
								Link addr.	ASDU addr.	Link addr.	ASDU addr.	Inf. obj. addr.	Status BI	Switch BI	Switch
1	IEC	0	11	1200	E	D	Y	54	54	1	1	2	2921		
2	IEC		12	9600	E	D	Y	1	1	1	2	2	2922		

#### Table “Lower level channels”

In this table the communication channels to substation devices are described. Columns have the following contents:

- **Channel** – Used for binding this table row with other tables. Table can't have two rows with same channel number.

- **Protocol** – Communication protocol, which is used by all devices of this channel:
  - **IEC** for IEC 60870-5-101 unbalanced mode and IEC 60870-5-103, also if over dial out channel
  - **IEC\_Bal-d** for IEC 60870-5-101 balanced mode
  - **IEC\_tcp\_ip** for IEC 60870-5-104 and IEC 60870-5-101 over TCP/IP channel
  - **IEC\_B\_tcp** for IEC 60870-5-101 balanced mode over TCP/IP channel
  - **IEC\_gprs** for IEC 60870-5-101 unbalanced mode over GPRS channel
  - **IEC\_gprs\_B** for IEC 60870-5-101 balanced mode over GPRS channel
  - **IEC\_gprs\_4** for IEC 60870-5-104 over GPRS channel
  - **Telem**
  - **ModBus** for Modbus RTU
  - **ModBus\_tcp** for Modbus TCP/IP
  - **ModBus\_nw** for Modbus RTU over TCP/IP channel
  - **OPC**
  - **IEC\_Cour** for Courier protocol on IEC 60870-5 link layer
  - **62056-21** for IEC 62056-21 meter protocol
  - **62056-21\_G** for IEC 62056-21 meter protocol over GPRS channel
  - **62056-21\_T** for IEC 62056-21 meter protocol over TCP/IP channel
  - **Tlm\_Board** for Telem-4 mimic board controller
  - **Num\_Board** for mimic board numeric displays
- **Port** – Number of communication port. This value should not be used for other lower or upper level channels, except in case of telephone offline channels where the same COM port number can be used for several lower level channels.  
 On IEC 60870-5-104 protocol this is the TCP/IP port no. In this case the Prot.ver. field in the controllers table for the controller of this channel has to be 104.
- **Speed** – Communication speed for all devices on this channel.
- **Parity** – The use of parity bit for all devices on this channel.  
 Possible values: N – not in use; O – odd; E – even.
- **Duplex (D/H)** – Determines, is the full- or half duplex mode used on this channel. Possible values are D and H.
- **Controllers** – The number of controllers in Controllers table, which are connected to this channel. This field is corrected automatically on launching the changes and on program startup.
- **Delay** – Delay between receiving data and next query in milliseconds.

- **In use (Y/N)** – Determines, is the channel currently in use.
- **Status inf. / Status BI** – ID number of “Internal” BI object, which is used for representing the communication status of the channel (OK or failure).
- **Status inf. / Telem addr.** – Number of virtual Telem controller (status controller), where the channel’s status mark is held. **This number must not be in use on any controller’s “Retr. addr.” field of Controllers table.**  
In setup the minimum possible number of different addresses should be used for status information.
- **Status inf. / Status TS** – Number of virtual TELEM controller’s binary input, which is used for representing the communication status of the channel (OK or failure).
- **Comment** – Short description or name (up to 20 symbols)
- **Phone #** – Phone number for offline channel. If the \* is added before the number, then the Gateway expects the callback from RTU side. Offline channels usually share the same COM port (same GSM modem).  
On IEC 60870-5-104 protocol this is the TCP/IP address.
- **Max.t.[s]** – Maximum connection time in seconds for offline channel.
- **Inq.int.[m]** – Periodical inquiry interval in minutes for offline channels. After this time period the Gateway dials to remote RTU for collecting all data.
- **Con.TC** – This is used only together with upper level Telem protocol. It is the number of virtual TELEM controller’s binary output used for creating the offline connection.
- **Con.TS** – This is used only together with upper level Telem protocol. It is the number of virtual TELEM controller’s binary input used for indicating the presence of offline connection.
- **Con.BO** – This is used together with upper level IEC 60870-5-101 protocol or SCADA server. It is the upper level object address of internal control object for creating the offline connection.
- **Con.BI** – This is used together with upper level IEC 60870-5-101 protocol or SCADA server. It is the upper level object address of internal BI object for indicating the presence of offline connection. Look also at p. 3.3.2.

**Table “Controllers”**

The communication parameters of substation devices are described in this table.

Columns have the following contents:

- **Contr.** – Used for binding this table row with other tables. Table can't have two rows with same controller number.
- **Channel** – Specifies the lower level channel, to which the controller is connected. Lower level channels table must have the row with this channel no. Controllers table can have up to 8 rows with same channel no.
- **Prot. ver.** – The number of protocol version. Used protocol is specified in table of lower level channels.

Possible TELEM protocol versions:

- 4 – TELEM-2
- 5 – TELEM-2A
- 6 – TELEM-2C
- 7 – TELEM- TS events recorder
- 9 – TELEM - TM 120
- 14 – TELEM-2 without energy enquiry
- 15 – TELEM-2A without energy enquiry
- 16 – TELEM-2C without energy enquiry

Possible IEC 60870-5-101 protocol versions:

- 0 – Measurement time = time tag + hour and date, got with time synchronization message (ABB). This is relevant on short time tagged messages.
- 1 – Measurement time = time tag + hour and date from TDC (Siemens). This is relevant on short time tagged messages.
- 2 – Same as ver. 0 + concentrator computer's time correction from lower level device.
- 5 – Same as ver. 0 + the SCADA system events are generated only on state changes, i.e. if the cause of transmission = 3 but the state does not change then the SCADA system event is not generated.

Possible IEC 60870-5-103 protocol versions:

- 103 – Normal
- 102 – Suppress echo if the reception is always enabled on RS-422 and RS-485 channels.

Possible IEC 60870-5-104 protocol versions:

- 104 – Normal
- 105 – The SCADA system events are generated only on state changes, i.e. if the cause of transmission = 3 but the state does not change then the SCADA system event is not generated.

- **Telem / Retr. addr.** – Retranslation address is the address of virtual TELEM controller, used by dispatch centers (upper level channels) for accessing the information. It can be same value with Link addr. field.
- **Link. addr.** – The address of substation device.
- **IEC / ASDU addr.** – The address of data unit in device.
- **IEC addr. lengths / Link addr.** – Length of link address in bytes.
- **IEC addr. lengths / ASDU addr.** – Length of ASDU address in bytes.
- **IEC addr. lengths / Inf. obj. addr.** – Length of information object address in bytes.
- **Time correction / Adjust. (Y/N)** – If Y is specified, the device's time is corrected once an hour, 5 min. after hour change.
- **Time correction / Addr.** – Address of time object in IEC device. Usually it can be left blank, which means zero.
- **In use (Y/N)** – Determines, is the controller currently in use.
- **Switch. chan.** – Used only in case of TELEM – TELEM conversion. This is the number of upper level channel, which is normally (by default) used for making switching operations of this TELEM device.
- **Status inf. / Status BI** – ID number of "Internal" BI object, which is used for representing the communication status of the channel (OK or failure).
- **Status inf. / Telem addr.** – Number of virtual Telem controller (status controller), where the controller's status mark is held. **This number must not be in use on any controller's "Retr. addr." field of Controllers table.**  
In setup the minimum possible number of different addresses should be used for status information.
- **Status inf. / Status TS** – Number of virtual TELEM controller's binary input, which is used for representing the communication status of the channel (OK or failure).
- **Comment** – Short description or name (up to 20 symbols)
- **Failure TS** – This is used on offline connection only together with upper level Telem protocol. It is the number of virtual TELEM controller's binary input used for indicating the communication status of RTU on last offline connection. It has value "1" if the RTU didn't communicate on last offline connection.
- **Failure BI** – This is used on offline connection together with upper level IEC 60870-5-101 protocol or SCADA server. It is the upper level object address of internal BI object for indicating the communication status of RTU on last offline connection. It has value "1" if the RTU didn't communicate on last offline connection. Look also at p. 3.3.2.

**Table “Upper level channels”**

In this table the communication channels to dispatch centers are described. Protocols to upper level can be Telem or IEC 60870-5-101

Columns have the following contents:

- **Channel** – Used for binding this table row with other tables. Table can't have two rows with same channel number.
- **Protocol** – Communication protocol, which is used on this channel:
  - **IEC** for IEC 60870-5-101 unbalanced mode
  - **IEC\_tcp\_ip** for IEC 60870-5-104
  - **Telem**
- **Prot. ver.** – The number of protocol version.  
Possible TELEM protocol versions:
  - 1 – Satelliit
  - 6 – TELEM-2C
 Possible IEC 60870-5-101 protocol versions:
  - 2 – Time correction from upper level is allowed
  - 6 – Long time tags are forced
  - 10 – GMT time messages and time tags are used
  - 11 – Time correction from upper level is allowed + GMT time messages and time tags are used +
  - 12 – GMT time messages and time tags are used + long time tags are forced
  - 13 – Time correction from upper level is allowed + GMT time messages and time tags are used + long time tags are forced
  - 104 – IEC 60870-5-104 server protocol. Time correction from upper level is allowed. (The other parameters of IEC 60870-5-104 server are set in TDC.conf file)
- **Port** – Number of communication port.
- **Speed** – Communication speed of this channel.
- **Parity** – The use of parity bit for this channel.  
Possible values: N – not in use; O – odd; E – even.
- **Duplex (D/H)** – Determines, is the full- or half duplex mode used on this channel. Possible values are D and H.
- **In use (Y/N)** – Determines, is the channel currently in use.
- **Status and ... / Status BI** – ID number of “Internal” BI object, which is used for representing the communication status of the channel (OK or failure).
- **Status and ... / Switch. BI** – ID number of “Internal” BI object, which represents the grabbing of all switching permissions (are all switching permissions grabbed by the dispatch center, which uses this channel).
- **Status and ... / Switch. BO** – ID number of “Internal” BO object, which is used for grabbing all switching permissions. Switching this

binary output to “ON” causes the grabbing of all permissions. Switching it to “OFF” restores the normal permissions.

- **Status and ... / Telem addr.** – Number of virtual Telem controller (status controller), where the channel’s status information is held. **This number must not be in use on any controller’s “Retr. addr.” field of Controllers table.**  
In setup the minimum possible number of different addresses should be used for status information.
- **Status and ... / Status TS** – Number of virtual TELEM controller’s binary input, which is used for representing the communication status of the channel (OK or failure).
- **Status and ... / Switch. TS** – Number of virtual TELEM controller’s binary input, which represents the grabbing of all switching permissions (are all switching permissions grabbed by the dispatch center, which uses this channel).
- **Status and ... / Switch. TC** – Number of virtual TELEM controller’s binary output, which is used for grabbing all switching permissions. Switching this binary output to “ON” causes the grabbing of all permissions. Switching it to “OFF” restores the normal permissions.
- **Comment** – Short description or name (up to 20 symbols)

If the setup changes are made (Strongly recommended to do in Telem SCADA Server side, not here) they are activated by pressing the button “Launch changes” or by restarting the program.

### 3.2. Configuration of measurement and control objects

Objects table is opened under the menu item *Settings / Objects*.

Table describes information object's parameters, source and destination devices and addresses.

(This table is not needed in case of TELEM – TELEM conversion)

Objects are arranged by identification number (ID).

Settings of IEC objects												
ID	Conv.	Type	LL contr.	LL obj.	LL param.	1.HL c/c	2.HL ch.	3.HL ch.	4.HL ch.	5.HL ch.	HL obj.	HL c.op.chan.
1	TLM->IEC	BO_S_SE	1	8		3					1	3 KOP F603:C1T 6kV
2	COR->TLM	BO_S_SE	1	1		3					2	1 KOP F635:C1T:6kV
3	TLM->IEC	BO_S_SE	2	3		3					3	3 KOP F602:C2T 6kV
4	TLM->IEC	BO_S_SE	2	4		3					4	3 KOP F638:C2T 6kV
5	TLM->IEC	BO_S_SE	1	10		3					5	3 KOP F617:SVL 1-2 S
6	TLM->IEC	BO_S_SE	1	11		3					6	3 KOP F619:SVL 3-4 S
7	TLM->IEC	BO_S_SE	2	7		3					7	3 KOP RLA 6kV 1-2 S
8	TLM->IEC	BO_S_SE	2	8		3					8	3 KOP RLA 6kV 3-4 S
21	COR->TLM	BI	1	32 1		3	8				21	KOP 11075:C1T 110
22	TLM->IEC	BI	2	1		3	8				22	KOP 11065:C2T 110
23	COR->TLM	BI	1	32 2		3	8				23	KOP 11005:SVL 110
24	COR->TLM	BI	1	32 3		3	8				24	KOP 35075:C1T 35
25	TLM->IEC	BI	2	2		3	8				25	KOP 35105:C2T 35
26	TLM->IEC	BI	1	4		3	8				26	KOP 35115:SVL 35
27	TLM->IEC	BI	1	5		3					27	KOP 35035:L35K16
28	TLM->IEC	BI	1	6		3					28	KOP 35055:L35K20
29	TLM->IEC	BI	1	7		3					29	KOP 35095:L35K6
30	TLM->IEC	BI	1	8		3	8				30	KOP F603:C1T 6kV
31	TLM->IEC	BI	1	9		3	8				31	KOP F635:C1T 6kV
32	TLM->IEC	BI	2	3		3	8				32	KOP F602:C2T 6kV
33	TLM->IEC	BI	2	4		3	8				33	KOP F638:C2T 6kV
34	TLM->IEC	BI	1	10		3	8				34	KOP F617:SVL 1-2 S
35	TLM->IEC	BI	1	11		3	8				35	KOP F619:SVL 3-4 S
36	TLM->IEC	BI	2	7		3					36	KOP RLA 6kV 1-2 S
37	TLM->IEC	BI	2	8		3					37	KOP RLA 6kV 3-4 S
38	TLM->IEC	BI	1	31		3					38	KOP Omatarve puudi
39	TLM->IEC	BI	1	16		3					39	KOP Maa 6kV 1.S

Columns have the following contents:

- **ID** – Unique identification number, which can't be same for two rows
- **Conv.** – Type of protocol conversion (TLM->IEC, IEC->TLM, IEC->IEC, COR->TLM, COR->IEC)
- **Type** – measurement type, which can have values:
  - AI – Analog measurement
  - BI – Binary input
  - II – Integrated input (pulse counter)
  - BO\_S\_SE – Binary output (single, select & execute)
  - BO\_S\_E – Binary output (single, execute)
  - BO\_D\_SE – Binary output (double, select & execute)
  - BO\_D\_E – Binary output (double, execute)



- **LL contr.** – Lower level controller number (from table Controllers under menu item *Settings / Channels and controllers*)
- **LL obj.** – Object no. in lower level controller.  
In case of IEC 60870-5-103 the function type is used here.
- **LL inf. no.** – Information no. of IEC 60870-5-103 protocol object. In case of other protocols must be empty or zero.
- **LL param.** – Lower level object's parameter (additional information).

On binary outputs it can have values:

- N\_I – No additional information (same as leaving blank)
- S\_P – Short pulse
- L\_P – Long pulse
- PRS – Persistent

On COURIER protocol binary inputs it specifies the bit no. in BI objects word. It can have extension for specifying the conformed control operation type.

Examples:

2 – 2nd bit of BI objects word

6T – 6th bit represents the control operation's "Trip" conformation

7C – 7th bit represents the control operation's "Close" conformation

- **1. HL c/c** – Higher level channel or controller number  
On IEC protocol this is the number communication channel from the table "Upper level channels".  
On TELEM protocol this is the number of virtual Telem controller.  
**This number must not be in use on any controller's "Retr. addr." field of Controllers table.**
- **2. HL ch.** – Second higher level IEC channel. It is used only on higher level IEC protocol.
- **3. HL ch.** – Third higher level IEC channel
- **4. HL ch.** – Fourth higher level IEC channel
- **5. HL ch.** – Fifth higher level IEC channel
- **HL obj.** – Object number on sending the value to higher level.  
On TELEM protocol this is the input no. of virtual TELEM controller.
- **HL c. op. chan.** – Used only with binary output (BO) objects. This is number of upper level channel, which is normally (by default) used for making control operations of BO object.
- **Name** – Up to 20 symbol name
- **Unit** – Up to 4 symbol name
- **DeadB** – Deadband is used with analog inputs (AI) on TELEM to IEC and COURIER to IEC conversions. It determines the minimal change of value, which causes sending it with IEC protocol to higher level.

- **Min val.** – Minimum value is used on IEC to TELEM and COURIER to TELEM conversions.

On lower level IEC protocol:

If the measurement is got in floating point form (IEC types 13 and 14), then the minimum value of the range is used together with maximum value for calculating the TELEM protocol value (opposite operation to scaling).

On measurement values got in normalized form (IEC types 9 and 10) the minimum value of the range influences the conversion in the following way:

- If the value is 0 or positive, then only the positive half of the range (0...1) is converted to TELEM variable
- If the value is negative, then the whole range (-1...1) is converted to TELEM variable

On lower level COURIER protocol:

The minimum value of the range is used together with maximum value for calculating the TELEM protocol value (opposite operation to scaling).

- **Max val.** – Maximum value is used on IEC to TELEM and COURIER to TELEM conversions for calculating the TELEM protocol value (opposite operation to scaling). See Min val. description.

### 3.3. Transfer of Concentrator's status information to upper level

#### 3.3.1. Concentrator's status information with TELEM protocol.

On TELEM protocol the Concentrator's status information is transferred using:

- Virtual binary input of special virtual TELEM controllers
- The TELEM device's status byte, which is transferred together with binary inputs of polled device (controller)

The following Concentrator's status information can be transferred to dispatch centers:

- The statuses of communication channels – is there a communication with all devices connected to this channel (OK or stopped). The virtual binary input is used for that.
- The statuses of lower level devices (controllers) – is there a communication with this device (OK or stopped). The virtual binary input is used for that.

- Which dispatch center has taken the switching operation permissions of all lower level devices. The virtual binary input is used for that.
- The new events are recorded. The TELEM device's status byte is used for that (this status byte is transferred together with binary inputs).
- There has been an error on buffering the events. The TELEM device's status byte is used for that (this status byte is transferred together with binary inputs).
- The measurement information is not updated due to failure of substation device or communication channel. The TELEM device's status byte is used for that (this status byte is transferred together with binary inputs).

Described virtual binary inputs are specified on setting up channels and controllers under main menu item *Settings / Channels and controllers*.

**NB!** The number of virtual Telem controllers, created for holding Concentrator status information, should be minimized. This means in channels and controllers setup window the minimal possible number of different addresses should be used on the corresponding TELEM address fields.

Status bits in TELEM device's status byte:

- D0 – “0” means new events in event buffer. It is set to “1”, if all new events are acquired
- D1 – “1” means the error on writing events to event buffer. It is cleared with TELEM protocol “Reset” command.
- D2 – “1” means that measurement data is not updated due to failure of substation device or communication channel. It is cleared if the cause is removed.

### 3.3.2. Concentrator's status information with IEC 60870-5-101 protocol.

On IEC protocol the Concentrator's status information is transferred using internal BI (binary input) objects. These BI objects have to be defined in objects table (menu item *Settings / IEC Objects*).

ID	Conv.	Type	LL contr.	LL obj.	LL inf.no	LL param.	1.HL c/c	2.HL c/c	3.HL c/c	4.HL c/c	5.HL c/c	HL obj.	HL c.op.chan.	Name
1	Internal	BI					1					10001		Status BI

For binding the internal object with status of channel or controller **the upper level object no.** from objects table is placed to appropriate column of channel or controller table (menu item *Settings / Channels and controllers*).

Chan.	Protocol	Port	Speed	Parity	Duplex (D/H)	Controllers	Delay	In use(Y/N)	Status BI	Telem addr.	StatusTS	Comment
1	IEC	2	9600	N	D	1		Y	10001			

The following Concentrator's status information can be transferred to dispatch centers:

- The statuses of communication channels – is the communication OK with all devices connected to this channel (OK or stopped). Column **Status BI** in tables of lower and upper level channels and **Con.BI** in table of lower level channels.
- The statuses of lower level devices (controllers) – is the communication OK with this device (OK or stopped). Columns **Status BI** and **Failure BI** in table "Controllers".
- The dispatch center has taken the switching operation permissions of all lower level devices. Column **Switch BI** in table "Upper level channels".

## 3.4. Switching permissions of dispatch centers

### 3.4.1. Change of switching permissions in case of TELEM - TELEM conversion

With TELEM protocol the switching operations, related to one substation TELEM controller, can be normally performed only via one certain upper level communication channel. This upper level communication channel is specified on setting up controllers under the main menu item *Settings / Channels and controllers*. Column "Switch. Chan." in controllers table.

Every dispatch center (upper level channel) can grab to itself switching permissions of all devices. This is done performing the switching operation of virtual TELEM status controller's certain binary output to "ON". This situation is indicated to higher level by certain binary input of virtual status controller. The normal switching permissions are restored performing the switching operation of the same binary output to "OFF".

If some dispatch center (upper level channel) has grabbed all switching permissions to itself, then every other dispatch center can still grab the permissions to itself.

According binary outputs and binary inputs of virtual TELEM controllers are specified on setting up upper level channels under the main menu item *Settings / Channels and controllers*.

### 3.4.2. Change of switching permissions in case of IEC protocol use

If the IEC protocol is used on lower or higher level, then every control object can be normally switched only via one certain upper level communication channel. This upper level communication channel is specified on setting up objects under the main menu item *Settings / Objects*. Column "HL c. op. Chan." in objects table.

Every dispatch center (upper level channel) can grab to itself switching permissions of all objects. This is done performing the switching operation of virtual binary output to "ON". This situation is indicated to higher level by certain virtual binary input. The normal switching permissions are restored performing the switching operation of the same binary output to "OFF". If some dispatch center (upper level channel) has grabbed switching permissions of all objects to itself, then every other dispatch center can still grab the permissions.

Depending on higher level protocol the virtual binary inputs and outputs are:

- Inputs and outputs of virtual TELEM status controllers
- Virtual IEC objects (Internal objects)

Related virtual binary outputs and inputs are specified on setting up upper level channels under the main menu item *Settings / Channels and controllers*.

## 3.5. Time synchronization configuration

### 3.5.1. Time synchronization of lower level devices

The time synchronization of lower level substation devices is configured in *Controllers* table.

There are two columns for that:

- **Time correction / Adjust. (Y/N)** – If Y is specified, the device's time is corrected once an hour, 5 min. after hour change.
- **Time correction / Addr.** – Address of time object in IEC device. Usually it can be left blank, which means zero.

### 3.5.2. Reception of time synchronization

The reception of time synchronization messages from upper level systems is configured in *Upper Level Channels* table.

The *Protocol version* field determines how the concentrator behaves in reaction to received time synchronization message and which kind of time tags are used.

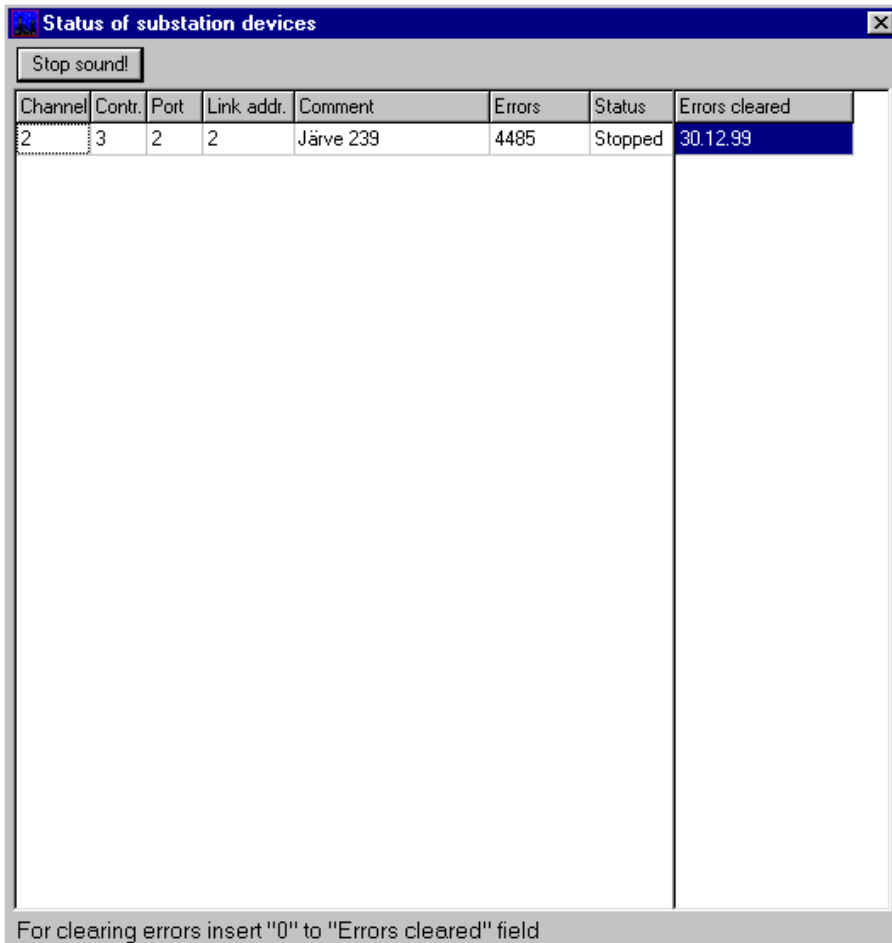
The possible *Protocol version* values in *Upper Level Channels* table are:

- 2 – Time correction from upper level is allowed
- 6 – Long time tags are forced
- 10 – GMT time messages and time tags are used
- 11 – Time correction from upper level is allowed +  
GMT time messages and time tags are used +
- 12 – GMT time messages and time tags are used +  
long time tags are forced
- 13 – Time correction from upper level is allowed +  
GMT time messages and time tags are used +  
long time tags are forced
- 104 – IEC 60870-5-104 server protocol. Time correction from  
upper level is allowed.

## 4. Displaying the status information

### 4.1. Displaying the status information of communication with lower level equipment

The window for displaying the status information of communication with substation devices is opened from the main menu item *Status / Substation devices*.



Channel	Contr.	Port	Link addr.	Comment	Errors	Status	Errors cleared
2	3	2	2	Järve 239	4485	Stopped	30.12.99

For clearing errors insert "0" to "Errors cleared" field

For every substation device the number of communication errors and status (the communication is taking place or not) is displayed.

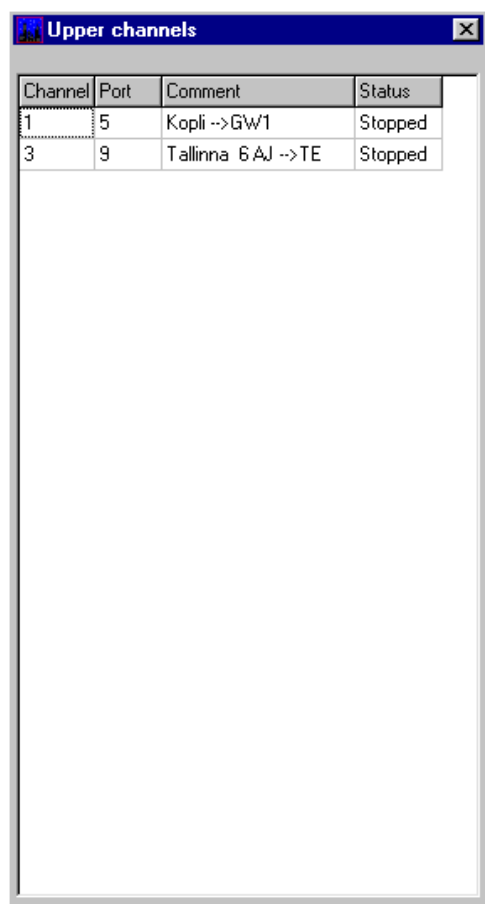
The number of communication errors is counted starting from time, displayed in the last column. For clearing the number of communication errors the "0" has to be inserted to the last column. After that the current time is placed to this last column.

If some of the substation devices do not answer to sent messages, then the alarm sound (beeps) is started and the message "Check communication!" is displayed in main window.

Alarm sound can be stopped by pressing button "Stop sound" or Enter key on keyboard in communication status window or in main window.

## 4.2. Displaying status information of upper level communication channels

The window for displaying the status information of upper level communication channels is opened from the main menu item *Status / Upper channels*.



The screenshot shows a window titled "Upper channels" with a close button. Inside the window is a table with four columns: Channel, Port, Comment, and Status. The table contains two rows of data.

Channel	Port	Comment	Status
1	5	Kopli --> G'W'1	Stopped
3	9	Tallinna 6 AJ --> TE	Stopped

For every upper level channel the status of communication is indicated (the communication is taking place or not).  
The number of communication errors is not counted for upper level channels and no alarm is given on stopped communication.

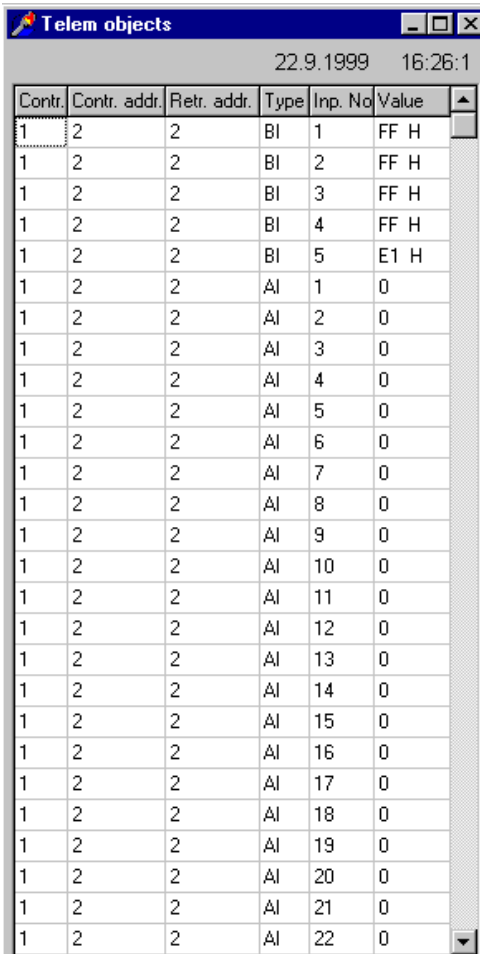


## 5. Displaying the measurement information

### 5.1. Displaying the measurement information on TELEM - TELEM conversion

In this window only TELEM -TELEM conversion related measurement information is displayed.

The window is opened from the main menu item *Measurements / TELEM objects*.



Contr.	Contr. addr.	Retr. addr.	Type	Inp. No	Value
1	2	2	BI	1	FF H
1	2	2	BI	2	FF H
1	2	2	BI	3	FF H
1	2	2	BI	4	FF H
1	2	2	BI	5	E1 H
1	2	2	AI	1	0
1	2	2	AI	2	0
1	2	2	AI	3	0
1	2	2	AI	4	0
1	2	2	AI	5	0
1	2	2	AI	6	0
1	2	2	AI	7	0
1	2	2	AI	8	0
1	2	2	AI	9	0
1	2	2	AI	10	0
1	2	2	AI	11	0
1	2	2	AI	12	0
1	2	2	AI	13	0
1	2	2	AI	14	0
1	2	2	AI	15	0
1	2	2	AI	16	0
1	2	2	AI	17	0
1	2	2	AI	18	0
1	2	2	AI	19	0
1	2	2	AI	20	0
1	2	2	AI	21	0
1	2	2	AI	22	0

Acquired measurement information is placed to column "Value".

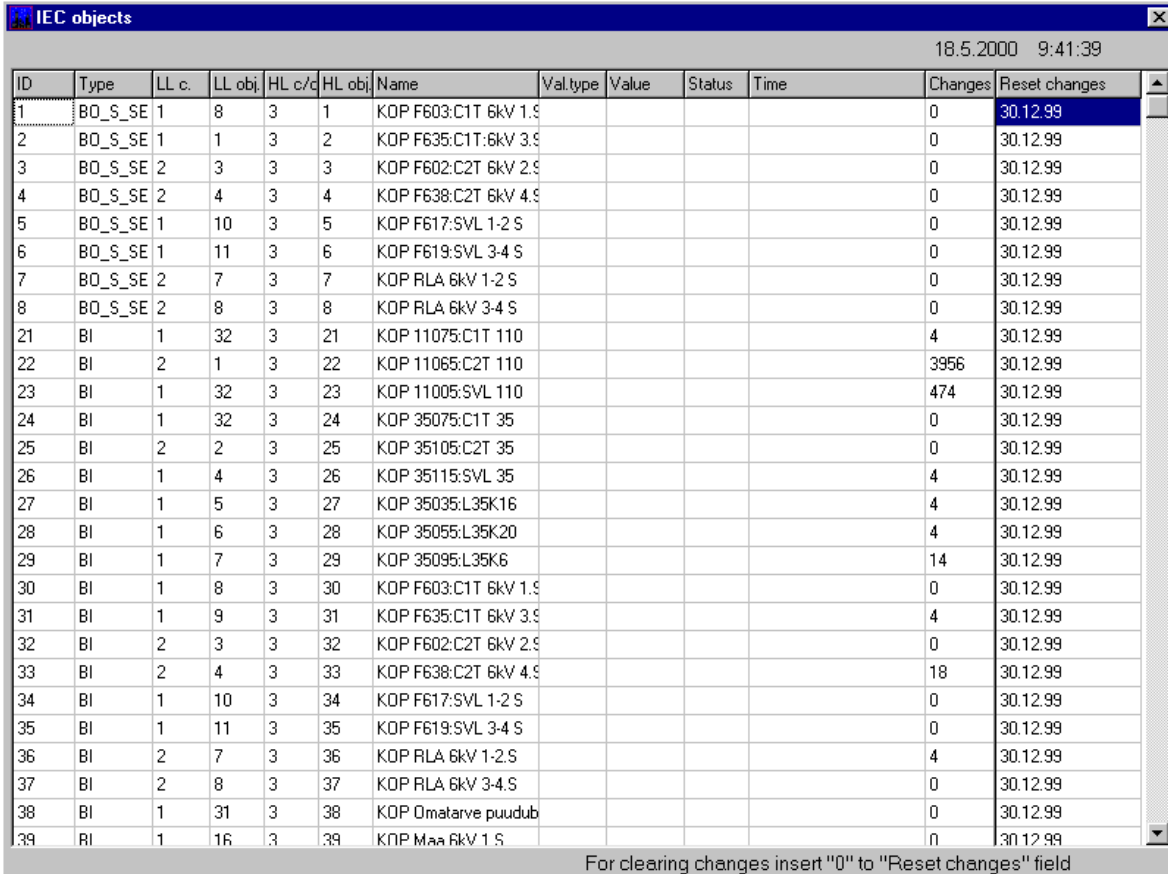
The values of binary inputs (BI) are displayed by bytes in hexadecimal form, where every bit of the byte represents one certain binary input.

The binary inputs 1..8 are matching to row "Inp. no. 1", binary inputs 9..16 to row "Inp. no. 2" etc.

## 5.2. Displaying the measurement information of configured objects

In this window the acquired measurement information is displayed for objects, used on TELEM to IEC, IEC to TELEM, IEC to IEC, COURIER to TELEM and COURIER to IEC protocol conversions.

The window is opened from the main menu item *Measurements / IEC objects*



ID	Type	LL c.	LL obj.	HL c/c	HL obj.	Name	Val.type	Value	Status	Time	Changes	Reset changes
1	BO_S_SE	1	8	3	1	KOP F603:C1T 6kV 1.5					0	30.12.99
2	BO_S_SE	1	1	3	2	KOP F635:C1T:6kV 3.5					0	30.12.99
3	BO_S_SE	2	3	3	3	KOP F602:C2T 6kV 2.5					0	30.12.99
4	BO_S_SE	2	4	3	4	KOP F638:C2T 6kV 4.5					0	30.12.99
5	BO_S_SE	1	10	3	5	KOP F617:SVL 1-2 S					0	30.12.99
6	BO_S_SE	1	11	3	6	KOP F619:SVL 3-4 S					0	30.12.99
7	BO_S_SE	2	7	3	7	KOP RLA 6kV 1-2 S					0	30.12.99
8	BO_S_SE	2	8	3	8	KOP RLA 6kV 3-4 S					0	30.12.99
21	BI	1	32	3	21	KOP 11075:C1T 110					4	30.12.99
22	BI	2	1	3	22	KOP 11065:C2T 110					3956	30.12.99
23	BI	1	32	3	23	KOP 11005:SVL 110					474	30.12.99
24	BI	1	32	3	24	KOP 35075:C1T 35					0	30.12.99
25	BI	2	2	3	25	KOP 35105:C2T 35					0	30.12.99
26	BI	1	4	3	26	KOP 35115:SVL 35					4	30.12.99
27	BI	1	5	3	27	KOP 35035:L35K16					4	30.12.99
28	BI	1	6	3	28	KOP 35055:L35K20					4	30.12.99
29	BI	1	7	3	29	KOP 35095:L35K6					14	30.12.99
30	BI	1	8	3	30	KOP F603:C1T 6kV 1.5					0	30.12.99
31	BI	1	9	3	31	KOP F635:C1T 6kV 3.5					4	30.12.99
32	BI	2	3	3	32	KOP F602:C2T 6kV 2.5					0	30.12.99
33	BI	2	4	3	33	KOP F638:C2T 6kV 4.5					18	30.12.99
34	BI	1	10	3	34	KOP F617:SVL 1-2 S					0	30.12.99
35	BI	1	11	3	35	KOP F619:SVL 3-4 S					0	30.12.99
36	BI	2	7	3	36	KOP RLA 6kV 1-2 S					4	30.12.99
37	BI	2	8	3	37	KOP RLA 6kV 3-4 S					0	30.12.99
38	BI	1	31	3	38	KOP Omatarve puudub					0	30.12.99
39	BI	1	16	3	39	KOP Maa 6kV 1 S					0	30.12.99

For clearing changes insert "0" to "Reset changes" field

The following fields are filled on the basis of gathered information:

- **Val. type** – Type code, which indicates the format of received measurement value.

On lower level IEC protocol it can have the following values:

- 1 – Single BI
- 2 – Single BI with time tag
- 3 – Double BI
- 4 – Double BI with time tag
- 5 – Step position
- 6 – Step position with time tag
- 9 – Normalized value of AI
- 10 – Normalized value of AI with time tag
- 13 – Floating point value of AI (in engineering units)
- 14 – Floating point value of AI with time tag

- 15 – Integrated totals (II) (counter)
- 16 – Integrated totals (II) with time tag

On lower level COURIER protocol it can have the following values:

- 32 – BI flag
- 36 – Unsigned integer
- 40 – Signed integer
- 44 – Courier number
- 48 – Extended Courier number
- 52 – IEEE floating point number

- **Value** – Measurement value

- **Status** – Used only on lower level IEC protocol. Nonzero value indicates, that measurement value can be incorrect.

Status value is composed of following elements:

- 1 – Overflow
- 16 – Blocked (Blocking and deblocking may be initiated, for example, by a local lock or a local automatic cause)
- 32 – Substituted (by operator or automatic source)
- 64 – Not topical (was not updated successfully during a specified time interval or it is unavailable)
- 128 – Invalid (abnormal conditions of the information source, missing or non-operating updating devices)

- **Time** – Measurement time. If the measurement comes with time tag, then the time based on this time tag. If the invalid bit is raised in time tag field, then the time is placed between the “?” marks.

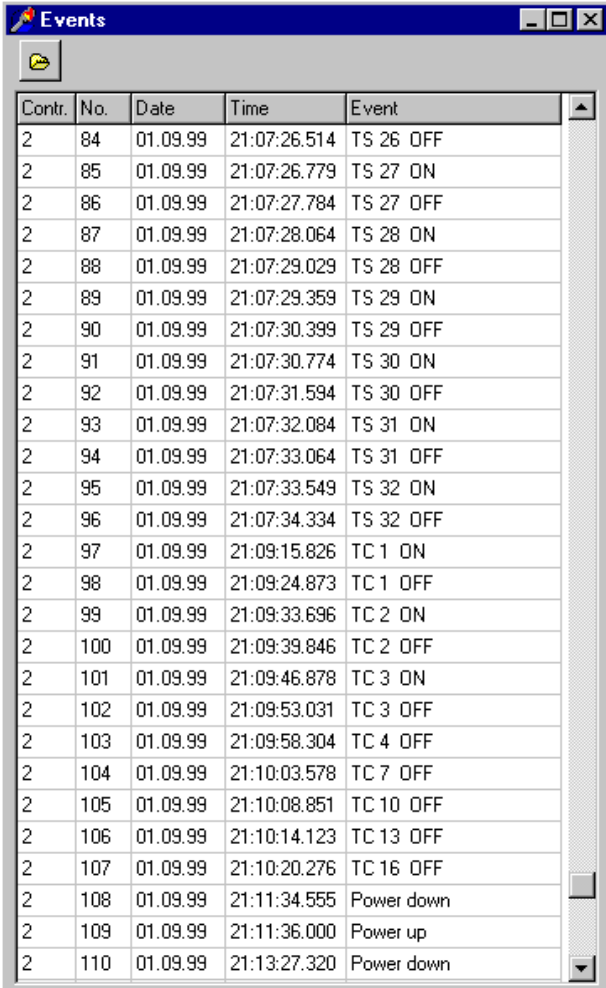
If the measurement comes without time tag, then the Concentrator’s time is used and the “!” mark is placed before it.

- **Changes** – The number of changes starting from time when this field was cleared.

Field **Reset changes** represents the time when the Changes field was cleared. For clearing the Changes field the “0” has to be inserted to this field.

### 5.3. Displaying buffered TELEM protocol events

In this window only these events are showed, which are related to virtual TELEM controllers and transferred over higher level TELEM channels. The window of buffered TELEM events is opened from the main menu item *Measurements / TELEM Events*.



The screenshot shows a window titled 'Events' with a table containing 17 rows of data. The table has five columns: 'Contr.', 'No.', 'Date', 'Time', and 'Event'. The data represents various status changes for different components (TS, TC) and power states (Power down, Power up) over time on 01.09.99.

Contr.	No.	Date	Time	Event
2	84	01.09.99	21:07:26.514	TS 26 OFF
2	85	01.09.99	21:07:26.779	TS 27 ON
2	86	01.09.99	21:07:27.784	TS 27 OFF
2	87	01.09.99	21:07:28.064	TS 28 ON
2	88	01.09.99	21:07:29.029	TS 28 OFF
2	89	01.09.99	21:07:29.359	TS 29 ON
2	90	01.09.99	21:07:30.399	TS 29 OFF
2	91	01.09.99	21:07:30.774	TS 30 ON
2	92	01.09.99	21:07:31.594	TS 30 OFF
2	93	01.09.99	21:07:32.084	TS 31 ON
2	94	01.09.99	21:07:33.064	TS 31 OFF
2	95	01.09.99	21:07:33.549	TS 32 ON
2	96	01.09.99	21:07:34.334	TS 32 OFF
2	97	01.09.99	21:09:15.826	TC 1 ON
2	98	01.09.99	21:09:24.873	TC 1 OFF
2	99	01.09.99	21:09:33.696	TC 2 ON
2	100	01.09.99	21:09:39.846	TC 2 OFF
2	101	01.09.99	21:09:46.878	TC 3 ON
2	102	01.09.99	21:09:53.031	TC 3 OFF
2	103	01.09.99	21:09:58.304	TC 4 OFF
2	104	01.09.99	21:10:03.578	TC 7 OFF
2	105	01.09.99	21:10:08.851	TC 10 OFF
2	106	01.09.99	21:10:14.123	TC 13 OFF
2	107	01.09.99	21:10:20.276	TC 16 OFF
2	108	01.09.99	21:11:34.555	Power down
2	109	01.09.99	21:11:36.000	Power up
2	110	01.09.99	21:13:27.320	Power down

The events are displayed in the order, they are gathered from substation devices. As this table contains the events from all substation devices, the events of different devices may be not in chronological order.

The last acquired event is on the last row of the table.

## 6. Configuring the Telem RTU-s

### 6.1. Configuring the RTU modules

Software enables the configuration of Telem RTU21 and RTU22 modules. Configuration transfer operations are made over IEC 60870-5-101 protocol. The configuration tables are opened from the Setup / *Controller's configuration* / ...

**Configuration of Telem controllers**

1 - No. of controller (look at Settings/Channels and controllers)

Comm. speed: 0 - 9600    Obj. base address: 0    GPS enabled: 0 - Ye

Contr. addr.: 1    Comm. port control: 0 - Online    Buffer depth: 44

ASDU address: 1    Type of per. meas.: 0 - Req.per.    Ref.v. correction: 0 c %

Type/version: CMB 1.03    (Loaded parameters are activated after Reset with code 1)

Load to contr.    Cancel

**Digital outp.**    IO type

No.	In use (Y/N)	Direct exec.	Length of short pulse	Number of short pulses	Length of long pulse	Number of long pulses
1	2 - In use	0 - No	0	1	0	1
2	2 - In use	0 - No	0	1	0	1
3	2 - In use	0 - No	0	1	0	1
4	2 - In use	0 - No	0	1	0	1

0 = 1500 ms    0 = 1    0 = 3000 ms    0 = 1

Parameters of all types are read    (Loaded parameters are activated after Reset with code 1)

Load from contr.    Load from copy    Load to contr.    Make copy    Cancel

At first for identifying the desired controller the no. of controller has to be inserted. This is the controller ID from controller's setup table (menu item *Settings / Channels and controllers*)

For reading the communication and I/O parameters from controller press the button "Load from contr."

Corrected communication or I/O parameters configuration is sent to controllers after pressing the button "Load to contr." on communication or I/O parameters area. "Cancel" buttons interrupt the sending operation.

**On RTU22 the configuration parameters of every I/O group are sent to RTU separately.**

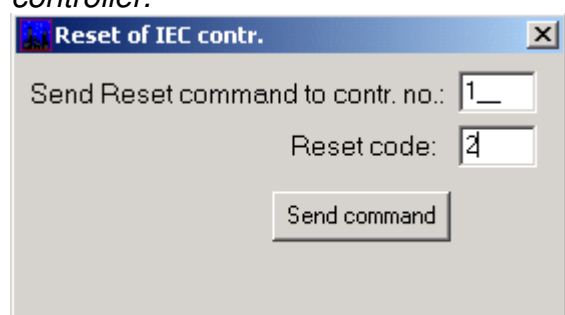
## New RTU configuration is activated after the Reset of RTU.

The RTU configuration information can be saved also to Zip file. For that press the “Make copy” button and indicate the folder and file names for Zip file. For extracting the RTU configuration from Zip file press the “Load from copy” button.

For meaning of I/O parameters look at controller manual.

## 6.2. Sending Reset command to Telem RTU modules

RTU Reset command window is opened from the menu item *Settings / Reset controller*.



The controller no. and Reset code have to be inserted.

Controller no. is the controller ID from controller's setup table (menu item *Settings / Channels and controllers*)

Reset code can have the following values:

- 1 – Reset
- 2 – Reset and **clear the internal memory buffers**
- 3 – Reset and **restore the default configuration**
- 4 – Reset and clear counter values

## 7. Updating Concentrator's program and configuration information

Updated files (new versions) are copied to Concentrator's hard disk over Ethernet LAN or via Dial-up network. In case of using Dial-up networking the modem is connected to COM 1.

Updating program:

- Copy new program files to folder  
C:\Telem\Concentrator\_replace
- Close and restart the Concentrator application program using keyboard or copy file RESET.CMP to folder C:\G\_Data, what causes restart of the computer within 2 minutes.

Updating configuration data:

- Copy new configuration data files (Paradox tables) to folder  
C:\Tlm\_Gateway\_Config\_replace (or configured folder name + "\_replace")
- Close and restart the Concentrator application program using keyboard or copy file RESET.CMP from C:\ to folder C:\G\_Data (or configured folder name), what causes the restart of the computer within 2 minutes.